

CLAIMS

1 A load distributing method comprising the step of:

5 path selection or path selection priority update for a pair of nodes, between which plural communication paths can be selected, upon every packet input to a transmission node, based on path status information on a selectable path, based on identification information on a time from which said path status information is effective or on a
10 transmitted packet, and based on a transmission history after the time from which said path status information is effective or a transmission history after transmission of the packet specified with transmitted packet identification information.

15 2 A load distributing method comprising the steps of:

monitoring a path status of each path selectable every packet input to a transmission node between two nodes, each which can select plural communication paths, and
20 storing path status information on said path status and a time from which said path status information is effective or packet identification information;

estimating a packet arrival prediction time in each path, based on path status information, and a packet
25 transmission history after the time from which said path

status information is effective or a packet transmission history after transmission of a packet specified with said transmitted packet identification information is transmitted; and

5 updating path selection or selection priority, based on said estimated arrival prediction time.

10 **3** The load distributing method defined in Claim 1, wherein said path status information includes a delay of a path.

15 **4** The load distributing method defined in Claim 1, wherein said path status information includes a transmission rate of a path.

20 **5** The load distributing method defined in Claim 1, wherein said path status information includes a load of a path.

25 **6** The load distributing method defined in Claim 1, further comprising the step of correcting a transmission cost calculation result regarding a packet transmitted before updating path status information of each path, when the path status information is updated for path selection or selection priority update.

7 The load distributing method defined in Claim 6,
further comprising the step of discarding a history prior
to a first packet transmitted on or after a time from
5 which the latest path status information is effective,
when a transmission cost calculation result of each path
is corrected.

8 The load distributing method defined in Claim 1,
10 further comprising the step of selecting as a packet
transmission path a path having an earliest estimation
value of a reception completion time at a reception node.

9 The load distributing method defined in Claim 1 further
15 comprising the step of selecting as a packet transmission
path a path having a largest estimation value of a data
amount, which can be completely received by a specific
time at a reception node.

20 10 The load distributing method defined in Claim 1,
further interrupting data transmission according to an
estimated current path status in each path.

11 The load distributing method defined in Claim 10,
25 wherein a condition for interruption of said data

transmission is that an estimated reception completion time is equal to or greater than a specific value.

5 **12** The load distributing method defined in Claim 1, wherein path selection or transmission interruption is determined according to a policy different for each attribute of transmission data.

10 **13** The load distributing method defines in Claim 1, further comprising the steps of:

 selecting a communications interface corresponding to a destination address of a reception packet from a table which associates an address of a communications interface with a destination address reachable using said
15 communications interface;

 selecting a communications interface corresponding to said transmission source address or a communications interface from among said selected communications interfaces when said reception packet has information
20 specifying a transmission source address or a communications interface;

 selecting a given communications interface from among said selected communications interfaces when said reception packet does not have information on a
25 transmission source address or a communications interface;

and

sending said reception packet to a selected communications interface.

5 **14** A node capable of selecting plural packet transmission paths, comprising:

means for updating path selection or selection priority every input packet, based on path status information on each selectable path, based on
10 identification information on time validating said path status information or on a transmitted packet, and based on a transmission history after the time from which said path status information is effective or a transmission history after transmission of a packet specified with
15 transmitted packet identification information.

15 A node capable of selecting plural packet transmission paths, comprising:

monitor means for monitoring a selectable path status
20 of each path every packet input at a transmission node and monitoring path status information on the path status and a time from which the path status information is effective or packet identification information;

memory means for storing said path status information
25 and a packet transmission history available after said

path status information is validated;

scheduling means for estimating an arrival prediction time of a packet in each path based on said path status information and based on a packet transmission history after said path status information is validated and updating path selection or selection priority based on said estimated arrival prediction time.

16 The node defined in Claim 15, wherein said path status information includes a delay of a path.

17 The node defined in Claim 15, wherein said path status information includes a transmission rate of a path.

18 The node defined in Claim 15, wherein said path status information includes a load of a path.

19 The node defined in Claim 15, wherein said scheduling means corrects a transmission cost calculation result regarding a packet transmitted prior or updating when path status information of each path is updated in the updating of path selection or selection priority.

20 The node defined in Claim 19, wherein said scheduling means discards a history before a first transmitted packet

validating latest path status information when a
transmission cost calculation result of each path is
corrected.

5 **21** The node defined in Claim 15, wherein said scheduling
means selects as a packet transmission path a path having
an earliest estimation value of a reception completion
time at a reception node.

10 **22** The node defined in Claim 15, wherein said scheduling
means selects as a packet transmission path a path having
a largest estimation value of a data amount which can be
completely received by a specific time at a reception node.

15 **23** The node defined in Claim 15, wherein said scheduling
means interrupts data transmission according to an
estimated current path status for each path.

20 **24** The node defined in Claim 23, wherein a condition for
interruption of said data transmission is that an
estimated reception completion time is equal to or greater
than a specific value.

25 **25** The node defined in Claim 15, wherein said scheduling
means determines the interruption of path selection or

transmission according to a policy different every attribute of a transmission data.

26 The node defined in Claim 15, further comprising:

5 a table in which an address of a communications interface is associated with a destination address reachable using said communications interface; and
 . routing means for selecting a communications interface corresponding to a destination address of a packet to be
10 transmitted, from said table, selecting a communications interface corresponding to said transmission source address or a communication interface from said selected communications interface when said transmission packet has a information specifying a transmission source address or
15 a communications interface, and sending said transmission packet to a selected communications interface.

27 A node control program, which is applicable to a node that can select plural packet transmission paths, said
20 node control program controlling said node as means for updating path selection or selection priority every input packet, based on selectable path status information on each path, based on identification information on time validating said path status information or on a
25 transmitted packet, and based on a transmission history

after the time from which said path status information is effective or a transmission history after transmission of a packet specified with transmitted packet identification information.

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28 A node control program, which is applicable to a node that can select plural packet transmission paths, said node control program controlling a node as:

monitoring means for monitoring a selectable path
10 status of each path for each packet input to a transmission node and monitoring path status information on said path status and identification information on time or packet validating said path status information; and

scheduling means for estimating a packet arrival
15 prediction time in each path based on said path status information and based on a transmission history of a packet after said path status information is validated and updating path selection or selection priority based on said estimated arrival prediction time.

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29 The node control program defined in Claim 28 wherein said path status information includes a delay of a path.

30 The node control program defined in Claim 28, wherein
25 said path status information includes a transmission rate

of a path.

31 The node control program defined in Claim 28, wherein said path status information includes a load of a path.

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32 The node control program defined in Claim 28, further controlling said scheduling means so as to correct a transmission cost calculation result regarding a packet transmitted prior or updating when path status information of each path is updated in the updating of path selection or selection priority.

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33 The node control program defined in Claim 32, further controlling said scheduling means so as to discard a history before a first transmitted packet validating latest path status information when a transmission cost calculation result of each path is corrected.

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34 The node control program defined in Claim 28, further controlling said scheduling means so as to select as a packet transmission path a path having an earliest estimation value of a reception completion time at a reception node.

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35 The node control program defined in Claim 28, further

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controlling said scheduling means so as to select as a packet transmission path a path having a largest estimation value of a data amount which can be completely received by a specific time at a reception node.

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36 The node control program defined in Claim 28, further controlling said scheduling means so as to interrupt data transmission according to an estimated current path status for each path.

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37 The node control program defined in Claim 36, wherein a condition for interruption of said data transmission is that an estimated reception completion time is equal to or greater than a specific value.

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38 The node control program defined in Claim 28, further controlling said scheduling means so as to determine path selection or transmission interruption according to a policy different every attribute of transmission data.

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39 The node control program defined in Claim 28, further operating as routing means that:

selects a communications interface corresponding to a destination address of a packet to be transmitted, from a table in which an address of a communications interface is

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associated with a destination address reachable using said communications interface,

selects a communications interface corresponding to said transmission source address or a communications interface, from said selected communications interface when said transmission packet has information specifying a transmission source address or a communications interface, and

transmits said packet to be transmitted, to said selected communications interface.

40 A transmission packet time estimation method for estimating an arrival time or a reception completion time of a transmission packet, comprising the steps of:

adding packet identification information for packet identification to a transmission packet transmitted from said transmission node and then transmitting said added information;

storing a transmission history of a transmitted packet, together with packet identification information, at said transmission node;

transmitting information on a path status from a reception node to a transmitter node, together with packet identification information on a last packet received in the path status; and

estimating an arrival time or a reception completion time to be transmitted in the transmission node, based on said path status and a transmission history of a packet transmitted subsequent to a packet specified with packet identification information contained in said path status information.

41 A node comprising:

means for adding packet identification information for packet identification to a transmission packet and transmitting said added information;

means for recording a transmission history of a transmitted packet, together with packet identification information; and

means for receiving path status information transmitted from a reception side and estimating an arrival time or reception completion time of a packet to be transmitted, based on said path status and based on a transmission history of a packet transmitted subsequent to a packet validating said path status.

42 A node control program for a node transmitting packets, said control program operating said node as:

means for adding packet identification information for packet identification to a transmission packet and then

transmitting the added information;

means for recording a transmission history of a transmitted packet, together with packet identification information; and

5 means for receiving path status information transmitted from a reception side and estimating an arrival time or reception completion time of a packet to be transmitted, based on said path status and based on a transmission history of a packet transmitted subsequent to
10 a packet validating said path status.